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SOME FACTORS AFFECTING ROOTING OF DOUGLAS-FIR AND TRUE FIR CUTTINGS

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ABSTRACT: Cuttings taken in January from young trees were treated in a variety of ways under intermittent mist to induce rootings. Bottom heat of 70°F. increased rooting over bottom heat of 60°F. More roots occurred in sand than in Sponge Rok. Rooting generally was not influenced by treatment with indolebutyric acid. Clonal differences in rootability ranged from 0 to 60 percent. Time required for callus to form was not related to time required for rooting to start.

The value of vegetative propagation in establishing superior lines of Christmas trees has been pointed out by Blankensop and Callaham (1960). For Douglas-fir (Pseudotsuga menziesii (Mirb.) Franco), white fir (Abies concolor (Gord. & Glend.) Lindl.), and California red fir (A. magnifica A. Murr.), rooting of cuttings would be a suitable technique if we knew the most favorable rooting conditions. Tests described here were designed to measure the influence of two soil media, two degrees of bottom heat, and one concentration of a single growth hormone on the rooting of cuttings from the three species.

Methods

Branch-tip cuttings were taken on January 5 and 6, 1961 from 5 Douglas-firs, 9 white firs, and 1 California red fir growing in Eldorado County, California. The Douglas-firs were 6 to 10 years old and growing at about 3,500 feet. The white firs were from two widely separated

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populations; one group 6 to 10 years old at 3,500 feet, and the other 30 to 40 years old at 6,400 to 7,100 feet. California red fir cuttings were from a tree 35 years old growing at the Institute of Forest Genetics, Placerville.

Cuttings from the Douglas-firs and low-elevation white firs were of the current year's wood and about 6 inches long. The California red fir and high-elevation white fir cuttings were shorter and often included wood 3 to 4 years old.

In the greenhouse two rooting beds were prepared with buried thermostatically controlled heat cables set at 60° and 70°F. Each bed was divided to accommodate two soil media--sand and Sponge Rok. Then in each of these four plots we randomly planted 30 cuttings from each of the 15 trees. Cut ends of half of the cuttings had been dipped in IBA (indolebutyric acid, 100 mg. in 100 g. talc); half of the cuttings were untreated. An intermittent mist spray was used throughout the test. Every two weeks the cuttings were examined for callus and root formation by C. M. Blankensop. Cuttings that died were discarded.

Results

Callusing started within 2 weeks of planting, and the first roots were struck after about 90 days. Rooting continued up to 322 days, when the study was stopped.

The data were analyzed by Rita R. Taylor. Analyses of variance disclosed that a soil temperature of 70°F. caused more rootings than 60°F; and more rootings occurred in sand than in Sponge Rok. Both differences were significant at the 5 percent probability level. Number of rootings was not influenced by treatment with IBA, except in 1 white fir clone which rooted slightly more frequently when untreated.

The effect of IBA on time required for roots to appear was studied by regression analysis. In Sponge Rok at 70°F. the hormone treatment caused a delay in rooting that was barely significant at the 5 percent level. In other combinations of soil and temperature no significant differences occurred (fig. 1).

Clonal differences in rootability were very pronounced. Duncan's multiple range test showed that at the 1 percent probability level 1 clone of Douglas-fir and 4 of white fir rooted significantly more cuttings than the other 10 clones. Of the 15 clones, only 1 failed to root a single cutting. This was one of the low-elevation white firs, most of whose closest neighbors were among the best rooters.

In the single California red fir clone only 1 cutting was rooted, but this appears to be the first rooting reported for this species. Overall rooting for the white firs was about 15 percent. The various clones ranged from 0 to 60 percent (table 1). Rooting of Douglas-fir was disappointingly low--only about 4 percent overall, and less than

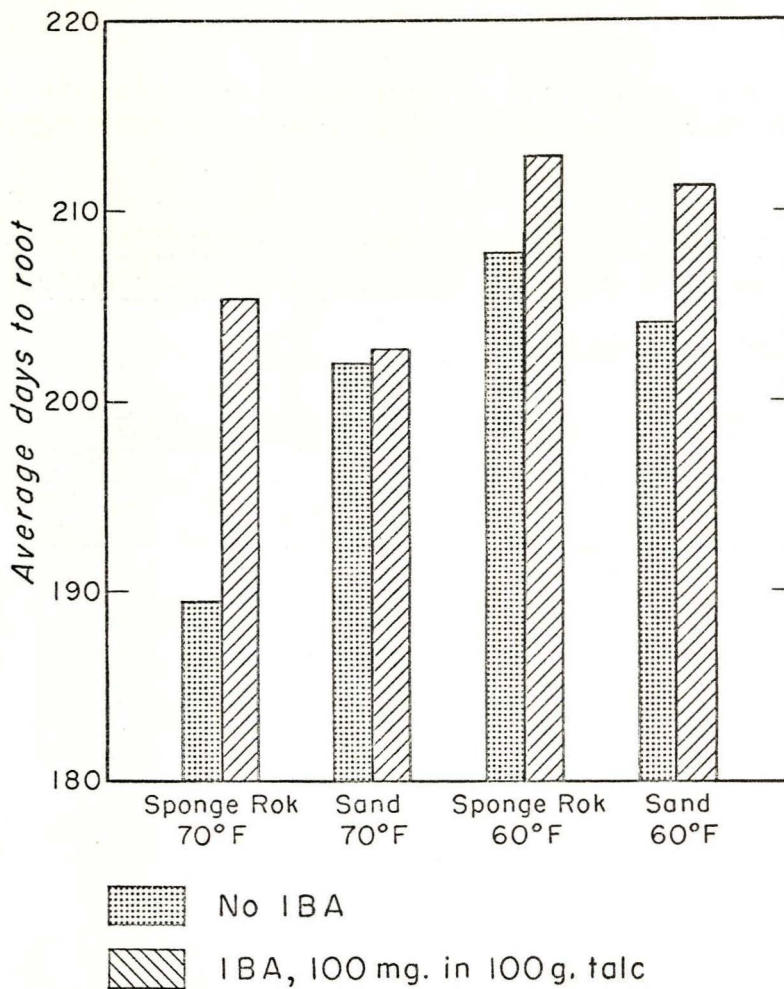


Figure 1.--Effect of indolebutyric acid treatment on promptness of rooting Douglas-fir, white fir, and California red fir.

11 percent for the best clone (table 1). Griffith (1940) obtained a take of 80 percent with a much lower concentration of IBA, and Blankensop and Callaham (1960) rooted 32 percent of Douglas-fir cuttings treated with an IBA concentration twice as strong as that in this test.

Scatter diagrams failed to show any relationship between time required to callus and time to root. Cuttings that callused early did not necessarily root sooner than those that callused slowly.

Conclusions

Because of the small scale of this test, these results can only be considered indicative. Higher rooting percentages may be obtained with cuttings collected earlier or later in the year, or with different concentrations of IBA or other hormones. The marked differences in rootability between clones will probably always introduce an element of uncertainty into such work, even when a single population of trees is sampled. Tentatively, it appears that sand is a suitable rooting medium, and that a soil

temperature of at least 70°F. is desirable. Indolebutyric acid in the concentration used served no useful purpose under the conditions of these tests.

Table 1.--Percent of cuttings rooted for three species propagated in 2 media at each of 2 temperatures with and without indolebutyric acid

Species & clone	: Sand :				: Sponge Rok :				: Combined treatments :
	: 60° :		: 70° :		: 60° :		: 70° :		
	: IBA	: No	: IBA	: No	: IBA	: No	: IBA	: No	
	: IBA	: IBA	: IBA	: IBA	: IBA	: IBA	: IBA	: IBA	
Douglas-fir									
1	0	7	0	7	0	0	0	7	2.5
2	0	0	20	7	0	0	0	0	3.3
3	7	7	7	27	7	0	13	20	10.8
4	0	7	7	7	0	0	0	0	2.5
5	0	0	7	13	0	0	0	0	2.5
Red fir									
1	0	0	0	0	0	0	0	7	0.8
White fir									
1	7	0	20	0	0	0	0	7	4.2
2	0	0	0	7	0	0	7	0	1.7
3	7	0	7	0	0	0	7	0	2.5
4	20	20	20	20	13	13	40	13	20.0
5	0	0	0	0	0	0	0	0	0
6	20	20	33	47	0	33	27	20	25.0
7	67	47	73	73	47	40	80	54	60.0
8	0	7	13	27	7	20	0	33	13.3
9	0	7	7	0	0	0	13	13	5.0
Combined clones									
15	8.4	8.0	14.2	16.0	4.9	7.1	12.4	11.6	

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